

CHOKE FOR CONTROLLING THE FLOW OF DRILLING MUD

The invention relates to a drilling system for drilling a well bore into an earth formation, comprising:

- drilling means for drilling a well bore;
- pumping means for pumping drilling fluid into the well bore during drilling; and
- a drilling fluid outlet system for retrieving drilling fluid from the well bore.

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Such a drilling system is for example known from WO-00 79092. In this publication it is disclosed that the drilling fluid outlet system is used to maintain control over the fluid pressure at the well bore wall, especially when drilling is stopped or during tripping of the drill string out of the bore hole. Without maintaining control over the pressure, there is a potential danger that undesired fluid flows from the earth formation into the bore hole, or that the borehole wall collapses.

According to prior art systems, the pressure is controlled by pumping fluid into the bore hole, via the annulus. Such a drilling fluid outlet system could further comprise a safety choke, in case the pump fails.

However due to large rock debris or contaminated mud, the safety choke could get clogged or could be damaged, which jeopardises correct control over the pressure in the well bore.

It is an object of the invention to alleviate the disadvantages of the prior art and to provide a system that is capable of regulating the pressure while the flow may contain large rock debris or contaminated mud.

This object is achieved by a drilling fluid outlet system comprising choke means for choking the returned flow of retrieved drilling fluid and alternating means for alternating the flow direction through the choke means.

So if the choke means would get clogged, the returned flow is alternated, such that the choke means are cleaned and the debris is discharged.

According to a preferred embodiment the drilling fluid outlet system comprises an inlet and an outlet, the choke means comprise a first inlet/outlet connection, a second outlet/inlet connection and the alternating means connect the inlet alternatingly to the first or second connection and the outlet alternatingly to the second or first connection. So with these alternating means it is possible to connect the choke means such that the inlet is used as an inlet or outlet and that at the same time the outlet is used as outlet or inlet.

In another embodiment of the drilling system according to the invention filter means are arranged in the first and second connection of the choke means.

These filter means block large pieces, which could damage the choke means. Upon alternating the flow direction blocked pieces at the filter means are discharged.

In again another embodiment of the drilling system according to the invention, the alternating means comprise a four way valve, having four connections and wherein the connections are connected two by two. With such a valve, which could be actuated automatically, alternating of the flow is performed quickly. This will provide a minimum interruption of the flow.

Preferably the drilling fluid outlet system comprises an accumulator. This accumulator secures a constant flow at the moment that the flow direction is alternated.

In yet another embodiment of the drilling system
5 according to the invention, the choking means comprises a bi-directional choke. Such a bi-directional choke provides a choking action in both flow directions. This provides for a compact design.

In another embodiment the choking means comprise at
10 least two uni-directional chokes. Such uni-directional chokes provide a choking action in only one flow direction. Therefore two chokes are necessary to provide a choking action in both flow directions.

The invention relates also to a drilling fluid outlet
15 system.

In another aspect the invention relates to a method of drilling a well bore into an earth formation.

In accordance with this aspect of the invention, the method comprises:

- drilling the well bore by operating drilling means;
20 - pumping drilling fluid into the well bore during said drilling; and
- retrieving drilling fluid from the well bore in a drilling fluid outlet system, said drilling fluid outlet system comprising choke means for choking the return flow of retrieved drilling fluid, whereby the flow direction of retrieved drilling fluid through the choking means is alternated for flushing away any debris from the choke means.
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30 The invention will be now illustrated by way of example and in conjunction with the accompanying drawings, wherein

Figure 1 shows a schematic view of a drilling system according to the invention;

Figure 2 shows a schematic view of a first embodiment of a drilling fluid outlet system according to the invention; and

Figure 3 shows a second embodiment of a drilling fluid outlet system according to the invention.

Figure 1 shows a schematic view of a drilling system 1 according to the invention. With this drilling system 1 a well bore 2 is drilled into the earth formation 3.

The drilling system 1 comprises a frame 4 onto which a fluid chamber 5 is slidably arranged along a guide 6. A drill string 7 with on its bottom end a drill bit 8 is rotated by a top drive 9 in order to drill the well bore 2. The well bore 2 is partially lined with a casing 10. The drill string 7 is composed out of a plurality of drill string joints 11, which are interconnected by connectors 12a en 12b. Drill mud contained in a reservoir 13 is pumped by pump 14 into the drill string 7 to the drill bit 8. The drilling mud 10 flows into the annulus between the well bore wall and the drill string 7 upwards. The annulus is closed off by a rotating blow out preventer 15. The drilling mud is returned via pipe 16 and drilling fluid outlet system 17 back to the reservoir 13. When connecting another drill string joint 11 the feed of drilling mud is taken over by pump 18, which pumps the drilling fluid into the chamber 5, such that it can flow into the drill string 7.

The drilling fluid outlet system 17 ensures that a certain pressure is maintained in the well bore 2 by choking the flow in the pipe 16.

In figure 2 the drilling fluid outlet system 17 is shown in more detail. The system 17 comprises a valve 20 and a bi-directional choke 21. In the position of the valve 20 as shown in figure 2 the inlet pipe 16 is connected to the first connection pipe 22 of the choke 21. The outlet pipe 19 is connected to the second connection 23 of the choke 21. When the choke 21 gets clogged, the valve 20 is rotated, such that the inlet pipe 16 is connected to the second connection 23 of the choke 21 and the outlet pipe 19 is connected to the first connection 22 of the choke 21. In this way the flow direction is alternated and any debris, which is clogging the choke 21 is flushed away through outlet pipe 19.

In figure 3 a second embodiment 30 of a drilling fluid outlet system according to the invention is shown. The system 30 again comprises a valve 31 and two uni-directional chokes 32 and 33. Such chokes 32,33 have a choking action in just one flow direction. Furthermore, the system 30 comprises filter means 34,35 which filter large debris in the mud, which could damage the chokes 32,33. To the inlet pipe 16 an accumulator 36 is connected, which ensures that a constant flow is maintained while the flow direction of the system 30 is alternated by turning the valve 31. Upon alternating the flow direction of the system 30 any debris present on the filter means 34,35 or in the chokes 32,33 is flushed away through outlet pipe 19.